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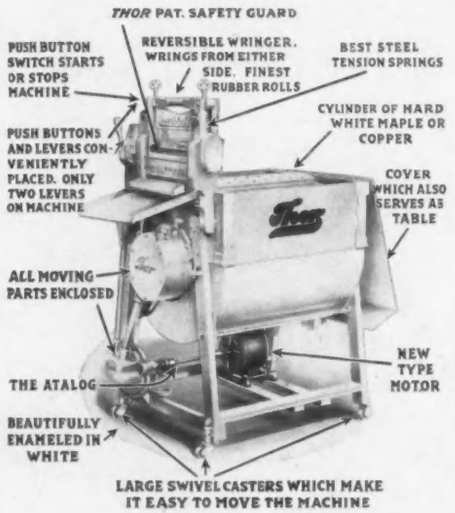
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# A FEW ORIGINAL STREET ELECTROLIERS

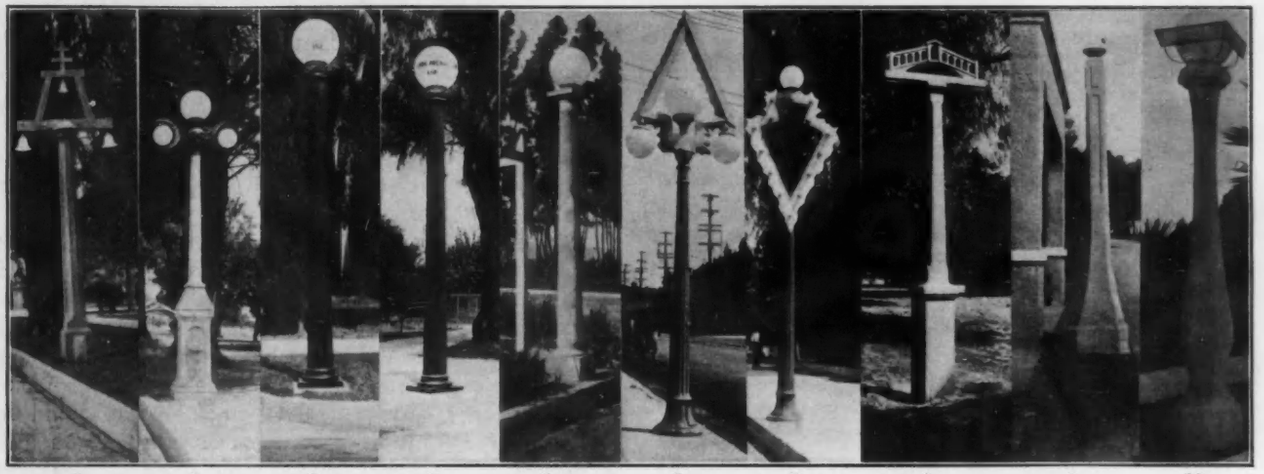
BY ALBERT MARPLE.

Probably nowhere else in this country is there the friendly rivalry between the municipalities with regard to the design and construction of electric street lights as there now exists in Southern California. During the past few months this spirit of contest has been growing until now it is at its height and as a result there is a greater variety of novel and artistic, yet at the same time entirely practical, electroliers in that section of the country than a person could find in any other given section of the world. These street lighting standards and globes are of almost every conceivable size and shape and they are generally made of either cement or steel or are a combination of the two. In most of the recent designs cement has been used exclusively, it having been found that there is nothing in the way of a building material that will "stand up" as will cement.

There is just a fragment of history behind the arrow and cross electric lighting standard shown in Fig. 1. This standard is at Riverside, and was designed to commemorate the old Spanish missions and also the Indians who were formerly possessors of the land where this city now stands. The "old timers" bring down to modern times stories of several interesting and important Indian battles which were fought on the present Riverside site and from these tales this city has been termed "The Arrowhead City." Right in keeping with this name is the arrowhead at the top of this standard. The small cross at the top of the standard as well as the white glass bell shades are tyical of the old Spanish missions, several of which still stand in that section. With the exception of the lights this feature is made entirely of cement.

Fig. 2 shows an attractive electrolier which is a sort of a "trade mark" for the city in which it is located. This is known as the "Crescent" city, and it will be seen that a crescent has been incorporated in the steel work of the lighting fixture. The standard portion of this fixture is made of cement. Toward the lower end of the post is a figure in the cement of a bell, which is typical of the Spanish missions which were formerly located in that section. Alhambra, where this photograph was taken, has a number of attractive municipal features.

One of the latest ideas to be introduced in that section in connection with the electroliers is that shown in Figs. 3 and 4. Heretofore the street names and the block numbers have been painted upon the sides of the frosted glass globes of these fixtures, and this idea is being used quite extensively, but never



1 2 3 4 5 6 7 8 9 10

Ornamental Lighting Standards in Southern California.

before have street numbers been painted upon the electroliers which happen to be located between corners. These lighting posts are located every 100 ft. between corners along this street and upon each of these is painted the number corresponding with the number of the home before which each electrolier is standing. This enables the person while driving by, both day and night, to tell the exact location of the home for which that person is looking. This idea is shown in Fig. 3. Up to this time the block numbers on the corner electroliers have been in the even hundreds, but along this thoroughfare the corner globes bear the numbers of the homes located on the corner lots. By this method the person who is searching for a home is not misled in the instance of the short block. The fourth illustration shows this. Fig. 5 is a reproduction of a modest little lighting standard in Culver City, one of a system of several hundred similar posts. In the instance of this feature, as in the Redlands electrolier, its simplicity is the "drawing card." In Figs. 7 and 8 are seen a pair of unusual "arrowhead" standards. These were found in San Bernardino. The standard in Fig. 6, pointed upward, is on the city's leading business street, while the other, with the inverted arrow, is one of a series of electroliers along one of the most prominent residence avenues. The pretty little all-cement standard shown in Fig. 8 is in Upland and is one of several hundred in this system. It bears two lights, the reflectors of which throw the light downward.

Another unusual single-light cement standard is seen in Fig. 9. This was found in San Fernando, and its plain, gracefully-tapering lines are its most attractive feature. A 16-inch globe rests upon this standard. Fig. 10 shows a concrete post with the street names attached. The white letters of the street names are upon a blue glass, which is supported by a metal frame.

A glance over the various lighting standards that have here been described will show that it is indeed worth the while for the residents and officials of a city to put a little time and study into the question of suitable electroliers. The attractive electrolier is not always the expensive feature. The lighting standard is one of the most prominent features of a city, and if the small amount of effort necessary for the producing of an original electrolier is expended, it will pay mighty big dividends. These illustrations show that this is a fact.

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**Small steam turbines,** those of 500 h.p. or less operating condensing, are well adapted for direct drive of small 60 cycle generators, d.c. generators, centrifugal pumping machinery under constant head and quantity, and fans and blowers delivering air at pressures from 1½ in. water column to 30 lb. per sq. in. When operating non-condensing they can be applied to the same purposes when steam economy is not the prime factor or where exhaust can be utilized. Geared units, operating condensing or non-condensing, are applicable to all these uses and in addition to many others which would otherwise fall in the category of the steam engine on account of the relatively slow speed of the apparatus to be driven. J. S. Barstow, in A. S. M. E. paper on "Turbines vs. Engines in Units of Small Capacities."

## DIESEL ENGINE PRACTICE.

BY J. E. MEGSON AND H. S. JONES.

(Continued.)

### Description and Experience of Earlier Installation.

One of the first plants to be operated commercially in America with Diesel engines was owned by the Manhattan Transit Company, located at Forty-seventh street and Second avenue, New York City. In 1902 this company purchased a 30 h.p. single cylinder Diesel engine, the cylinder dimensions being 10 by 15 in. The power was to be used in generating current for charging electric vehicles. It was superseded by two twin cylinder engines of 60 h.p. each. These were, in turn, superseded by two 75 h.p. triple cylinder machines.

The first three engines installed were belted to direct current generators. The last two 75 h.p. were direct connected to the same type of electric generator. All of these engines had separately driven air compressors of the two-stage Ingersoll-Rand type. The two last engines installed are still in operation. The first three, however, have been junked. All of these engines were of the splash lubrication type. The last two 75 h.p triple cylinder machines installed were of the same type and design as those built by the American Diesel Engine Company until the latter part of 1914.

In the first engines installed the admission valves were automatically operated, opening inward, being closed by a spring. The exhaust valves and fuel valves were operated by an eccentric and pin operating a rod connecting to the valves which were closed by springs, while the fuel valves were of the horizontal type. One of these engines was wrecked, due to a broken connecting rod which at that time was made of cast iron. The second one was wrecked due to mechanical troubles.

The two last 75 h.p. engines installed in this plant, having three 25 h.p. cylinders, were designed by the late Mr. James McPherson and manufactured in Providence, R. I., at the old Corliss engine works, the dimensions of the cylinders being 10 by 15 in. They had splash lubrication and a cam shaft running through the crank case with cams to open the exhaust and fuel valve; the admission valve of this engine was automatic, similar to that on the first design. This type was a distinct advantage over the first American design, one of the new features being removable heads, which were adopted with this engine for the first time in this country. Six air bottles or steel tanks were supplied with each engine of approximately 8 in. in diameter and 8 ft. in length; they were imported from abroad and tested at 3000 lb. per sq. in. Pennsylvania crude oil was used for fuel, being purchased in barrels at a cost of 4 cents a gallon. The plant was visited daily by prominent men of New York City, especially from Wall street. The owners of the Manhattan Transit Company were important figures in the financial district and enthusiastic about Diesel engines.

The machines operated 24 hours a day and after the last engines were installed furnished lights for the business block as well as furnishing current for charging the electric vehicles. Mr. McPherson, in designing this last engine, in no way followed European practice and after the successful operation of this size he

designed engines of 120 h.p., 170 h.p. and 225 h.p. All engines were built with three cylinders with compressors either belt driven from the engine or motor driven. The 225 h.p. engine shown in Fig. 9 consisted of three 16 in. by 24 in. cylinders, the cranks being set at 120 degrees; the connecting rods with wrist pin bolts were made of forged steel, while for the first time all valves were mechanically operated from cams. The admission valve was set in a cage while the exhaust valve had no cage, the seat being part of the head. The fuel needle was set horizontally and was mechanically operated from the cam shaft, the atomizers being made of bronze. The clearance at the

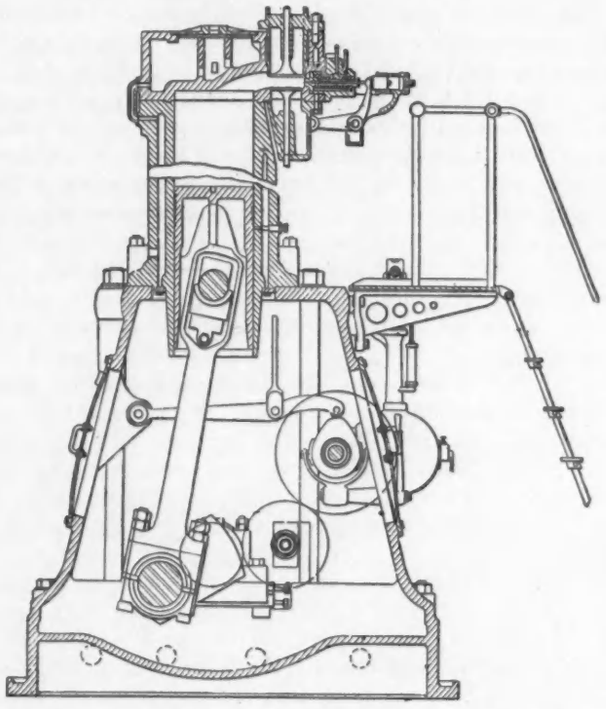


Fig. 9. Sectional Drawing of American Diesel Engine.

top of the pistons was ⅛ in., this clearance giving a compression of 500 lb. per sq. in. and a consequent temperature of 1000 deg. Fahrenheit, the pistons having four compression rings but without wiper rings. The combustion chamber extended over between the exhaust and admission valve. The cylinders were solid, being of one casting, having no liners, as in the present types. These cylinders were water jacketed and a bypass led the water into the head while cooling water was also used in the exhaust chambers. The main bearings were babbitt lined and permitted of adjustment by wedges. These engines were started from one cylinder which was provided with a starting valve in addition to the usual inlet, exhaust and fuel valves.

The first three engines of 225 h.p. were shipped to St. Louis and installed in the Tyrolean Alps, a concession in the Louisiana Purchase Exposition in 1904. The engines were direct connected to direct current generators and supplied light and power for the Tyrolean Alps. The first engine was started at 11 a. m. ad ran until midnight, the other two were cut in at dusk. During the entire fair there was no time that they were without light and power. After the fair one engine was sold to the Baldwin Locomotive Works in Philadelphia, and two to Ball Brothers Glass Company, Muncie, Indiana. All three are still in operation in connection with others afterwards purchased and installed in the same plants. The power house at the Tyrolean Alps was typical, laid out and set up in the latest and most approved manner at that time, two engines being arranged on one side of the room, the third being on the opposite side. The three compressors were set to one side of the engine room, one being of the Ingersoll-Rand type, two-stage horizontal and two built by the American Diesel Engine Company at Providence, R. I., of the two-stage vertical type, all motor driven. These engines at the Tyrolean Alps attracted a great deal of attention, thousands of people stopping daily to observe what was termed at that time the handsomest machinery in the world. The engines were painted with black enamel paint and had gold trimmings, the room was fitted with hardwood polished floor, in fact everything appeared as if it was intended for permanent operation. Of course, at that time there were few people who knew much, if anything about the Diesel engine, and it was a great curiosity.

Machinery Hall at the St. Louis Fair was an extremely large building. Many different designs of steam engines were installed and in operation, but at that time the semi-Diesel, as they call it today, was not even known. The Mietz & Weiss Co. of New York, exhibited a coal-oil engine and the Otto Gas Engine Company were about the only ones in the hall, a Webber gas producer being set up out in the boiler room and at that time was looked upon as being somewhat dangerous.

The real business of the American Diesel Engine Company, we might say, started at the St. Louis Exposition. A large number of engines were sold from this exhibit and during the year there was a plant installed in Sherman, Tex., for lighting the city. This plant afterwards was bought by the Texas Power & Light Company, who now have in operation approximately 20 or more Diesel engines and are still buying, even though they have a large and up to date steam turbine plant for some of their work. The Gorham Silver Company at Providence, R. I., The Prairie Pebble Phosphate Company of Mulberry, Fla., and numerous other plants were sold in this year.

The Prairie Pebble Phosphate Company purchased engines in 1907, 1910, 1912 and 1914 so that all told they have 19 Diesel engines in operation daily, Sixteen of their engines are set up in double units, making eight 300 kw. sets. These engines all run in parallel, driving sixty cycle alternating current generators of 2300 volts. The power in this plant is used for driving centrifugal pumps for hydraulicing the banks of phosphate rock, which is used as a fertilizer and a large majority of the thousands of tons obtained daily are shipped to foreign countries, largely to Germany.

The Sherman, Texas, plant furnishes light for the city of Sherman, supplying 24 hours service. The tests on this engine are shown in the accompanying table as having been made in January, 1905, the yearly operating log being shown also. During the year from March, 1912, to February, 1913, it is interesting to note how nearly the fuel consumption over the year's opera-

**TABLE I. OFFICIAL ACCEPTANCE TEST, SHERMAN, TEX., JANUARY 1, 1905.**

**Three Cylinder 16x24, 225 B.H.P. Diesel Engine No. 138.**

| Time. | Volts. | Amp. | R.P.M. | Oil. | Oil Consumed Gal. | Air Pressure. | K.W. |
|---|---|---|---|---|---|---|---|
| 5 p. m. | 242 | 640 | 162 | ..... | ..... | 72 atm. | ..... |
| 7 p. m. | 242 | 635 | 164 | 19.0 | 16.0 | 71 atm. | 156.7 |
| 9 p. m. | 240 | 655 | 163 | 18.0 | 15.5 | 70 atm. | 159.0 |
| 11 p. m. | 243 | 620 | 164 | 15.5 | 15.5 | 67 atm. | 158.0 |
| 1 a. m. | 238 | 640 | 104 | 13.0 | 13.0 | ..... | 159.0 |
| 3 a. m. | 239 | 655 | 163 | 14.0 | 14.0 | 69 atm. | 157.0 |
| 5 a. m. | 240 | 650 | 164 | 14.5 | 14.5 | 69 atm. | 161.0 |
| 7 a. m. | 239 | 665 | 164 | 14.0 | 14.0 | 69 atm. | 160.0 |
| 9 a. m. | 238 | 670 | 163 | 14.0 | 14.0 | 70 atm. | 160.0 |
| 11 a. m. | 240 | 655 | 164 | 13.5 | 13.5 | 70 atm. | 160.5 |
| 1 p. m. | 238 | 665 | 164 | 14.0 | 14.0 | 70 atm. | 157.0 |
| 3 p. m. | 242 | 660 | 162 | 15.75 | 15.75 | 70 atm. | 161.6 |
| 5 p. m. | 243 | 675 | 160 | 17.75 | 17.75 | 72 atm. | 168.5 |

**Total KW. Developed During Test.**

Total hours run.....24
Total kw. developed.....38325
Average kw. developed per hr..159.6—232.4 h.p. at 92% Gen. Eff.
Max. kw. developed in 1 hr.....168.5—245.0 h.p. at 92% Gen. Eff.
Average air pressure.....70 atmospheres

(Oil consumption as shown averages 9.41 gal. per 100 kw.-hr.—6.46 gal. per b.h.p. hr.)

**450 kw. Diesel Engine, Central Station Installation.**

| Month. | Output kw.-hr. | Load Factor. Per Cent. | Total Operation and Maintenance. Mills Per kw.-hr. |
|---|---|---|---|
| 1912. | | | |
| March ..... | 95,328 | 28.4 | 5.31 |
| April ..... | 77,915 | 24.0 | 6.88 |
| May ..... | 76,820 | 23.0 | 6.70 |
| June ..... | 70,230 | 21.7 | 7.96 |
| July ..... | 91,704 | 27.4 | 8.05 |
| August ..... | 85,105 | 25.4 | 9.50 |
| September ..... | 105,506 | 32.5 | 5.83 |
| October ..... | 117,360 | 34.7 | 7.28 |
| November ..... | 114,048 | 35.2 | 6.43 |
| December ..... | 117,499 | 35.1 | 4.69 |
| 1913 | | | |
| January ..... | 115,212 | 34.1 | 6.22 |
| February ..... | 101,300 | 33.5 | 5.10 |
| Total ..... | 1,168,027 | .... | .... |
| Average ..... | 97,335 | 29.6 | 6.66 |

**Physical Data.**

H.P. rating of plant, 675. No. of engines, 3. Size of each, 225 h..p
Cost of fuel oil f.o.b. plant, per bbl., $1.05. Per gal., .025.

B.t.u. of oil, 18,000. Average gal. fuel oil per 100 kw.-hr., 10.2.
Wages of men per day, $9; 1 at $3.33; 1 at $2.17; 1 at $2; 1 at $1.50.

tion approached the fuel consumption on full load tests seven years before, showing conclusively that the Diesel not only maintains its original economy but also is extremely economical on the fluctuating loads of a central station.

Another interesting plant is that of the Key West Electric Company at Key West, Florida, who were among the early purchasers of Diesel engines. They operated at first in connection with their steam plant two 225 h.p. engines belted to a jack-shaft, to which also was belted their steam engines and from that a large belt running to a generator. In the spring of 1907 they installed a third 225 h.p. to operate their trolley system and these engines are all in operation at the present time. In 1908 the Diesels were disconnected from the jack-shaft and individual generators installed, direct connected to the engines. The engine that operates their trolley system also operates their electric fan circuit, and as Key West is a city of 25,000 and quite warm the year round, the fan load is considerable. This engine does 18 hours a day service year in and year out. The conditions at Key West, Fla., make it hard to maintain any kind of machinery, as the salt atmosphere necessitates the changing of all water piping every six months or at least once a year. The water used for circulation is of the worst kind, as naturally there is no fresh water on the island of Key West, excepting rain water, which is only used for household purposes, all other water being obtained from inland wells whose water is brackish on account of its proximity to the ocean.

A great many Diesel engines of this same type with some improvements, have been sold and put in operation in over half the states of the Union and in fifty-nine or more different kinds of industries. Diesel engines today are driving ice machines, flour mills, chocolate factories, woolen mills, cotton mills, paper mills and innumerable other industries. One flour mill with a capacity of 1000 barrels per 24 hr. formerly used 55 to 58 bbl. of fuel oil under boilers every 24 hr. This plant now with Diesel engines turns out the same amount of flour on from 11 to 13 bbl., a saving of over $1100 a month in fuel alone. There are ice plants being operated with Diesel engines in some of our hottest states, such as Louisiana, that are making ice at a fuel expense of 18 cents a ton.

The public, in general, has heard more or less of the troubles with Diesel engines, but it is the same thing with any new invention placed upon the market. In a steam plant, for instance, the boiler could blow up and kill a half dozen people. Someone would say, "Why, that's too bad, but we will have to buy a new boiler." But when it comes to the Diesel engine, if a minor difficulty should occur and cause the lights or power to be off for ten minutes, everyone would have "their sign out"—"I told you so. That engine is no good," etc. Diesel engines up to the present time have never had an honest chance. A great majority of those put out into the world are operated by men who simply know if they open this valve or that, that the engine will start or stop, with no idea of the care that is necessary to make an engine operate successfully.

Another thing that has always seemed strange is that the purchaser of a $25,000 steam plant will want the best steam engineer he can obtain at almost any price to care for and operate his plant, a man who has had years of training along this line, but when the same man or one of his type, purchases a Diesel engine plant costing $25,000, he generally tries to get the cheapest man possible to operate it. Diesel engines require more care and attention than steam engines, not considering the boiler plant or pumps and auxiliaries. There are approximately five times as many parts, or more, to a Diesel engine as there are to a steam engine, and lost motion on all these parts is considerable. The writer recalls a plant that he visited at one time in Arizona. The engine had been operating almost continuously, night and day, for four years, furnishing power for a water pumping station. As he entered the plant the engine sounded more like a stone crusher than an engine and this noise all came from lost motion in the valve gear, caused by neglect and lack of knowledge. The following day when the engine was shut down for inspection the lost motion was found between the cams and the rollers connected to the rods that open the exhaust and admission valves to have from ½ in. to ¾ in. clearance instead of only 1/32 in. On asking the engineer what this meant he said not to blame him; that the man who erected the engine set the rollers that way, four years before, and he had never touched them. That was his idea of operating and caring for a Diesel engine!

(To be continued.)

# REPORT ON THE COLUMBIA POWER PROJECT.

BY L. F. HARZA.

(Continued.)

## Appendix A—Power Site Topography and Geology.

**Topographic surveys.** The datum adopted for all surveys and designs related to this project is mean sea level. Reference to this datum was obtained from the Seattle-to-Huntington precise level line of the U.S. Coast and Geodetic Survey, using the bench mark in Taffe's yard at Celilo, Oregon, the elevation of which is 159.694 above mean sea level, 1912 adjustment.

Several maps and diagrams of the Corps of Engineers, U.S.A., which were made for the design of the Celilo Canal, were used. In their surveys the same bench mark was used but was referred to the arbitrary datum of their survey of 1879, made before the level work of the Coast Survey. The elevation of this datum above mean sea level is 37.07 feet.

Numerous bench marks used by the U. S. Engineers in the construction of the Celilo Canal were used, by correction of datum, for vertical control between Big Eddy and Celilo. Above Celilo vertical control was obtained by running a line of levels on each side of the river, following the railroad grades and using the elevations of tops of rail at each mile post as bench marks.

Horizontal control between Big Eddy and Celilo was secured by the use of the triangulation points of the U. S. Engineers' survey of 1879, a sufficient number of which were identified by checking over the old survey with a preliminary traverse line using stadia distances. From Celilo upward to the John Day River, the limit of the survey, horizontal control was secured by planetable triangulation with occasional checking by actual measurement with a tape and by the known alignment of the railroads taken from their maps and profiles, from which also the land subdivisions were transferred without field survey.

Two topographic maps were made: a map of "Site Topography" with a scale of 100 ft. to the inch and with 5 ft. contour interval, and a General Topographic map from The Dalles to the mouth of the John Day River, about thirty miles, scale 500 ft. to the inch with 5 ft. contour interval. This latter map has not been reproduced in the report because of its immense size, but a general location map showing the stretch of the river affected by the backwater and covered by the large map, is shown in Fig. 1, (published on p. 376 of this journal of Nov. 13, 1915), and will be further discussed in relation to property damages.

**Power site topography.** Fig. 9 (See p. 394, Nov. 20th issue of this journal), is a map of the portion of the river of interest in connection with the proposed structures. It has been adapted for illustrative purposes, with only 10 ft. contour interval and some further sacrifice of detail, from the original planetable map of "Site Topography" above mentioned. At the upstream or right end of the map is shown a wide river channel which suddenly reduces from a width of about 1800 ft. to a width of only about 130 ft., and continues between two rock walls in a very narrow and deep channel known as "Five Mile Rapids" to "Big Eddy," about one and one-half miles below. From there it follows a tortuous channel to Three Mile Rapids about one mile farther.

The benches on both sides of Five Mile Rapids are largely subject to overflow in extreme high water. The surface of these benches consists of extremely rough, rugged basalt rock (shown in Plate II), which is badly cut by overflow channels and holes scoured by the eddies. The bench on the right, or Washington side, which has been tentatively chosen as a canal location, varies from about 500 to 1800 ft. in width. Along this bench is built the main line of the Spokane, Portland & Seattle Railroad. On the left, or Oregon, side is the main line of the Oregon-Washington Railroad & Navigation Company and the United States Navigation canal nearing completion by the Corps of Engineers, U. S. Army. Several salmon wheels belonging to Seufert Brothers & Company are shown along the gorge. On the Washington or right side, just below where the river enters the narrow gorge, is the Indian town of Wishram, whose inhabitants subsist by salmon fishing in the rapids.

The entire topography on the Washington or right side of the river, as well as that on the Oregon side at the damsite, was taken by planetable method. The topography on the Oregon side except at the damsite was traced, by changing the datum to sea level, from the map of "The Dalles, Columbia River Survey," made by F. W. Lenhartz under the direction of Lieutenant Charles F. Powell, Corps of Engineers, U. S. A., November and December, 1879.

**Geology of the site.** The native rock as exposed in the bluffs along the Columbia River Valley for many miles above and below the site of the proposed power development consists of many distinct basaltic lava sheets superimposed one upon the other, their contacts often being distinctly visible due to the characteristically stepped appearance caused by erosion. Le Conte describes as many as thirty flows exposed in the canyon of the Deschutes River only a few miles from the proposed power site and in a continuation of the same lava structure. These strata of lava evidently represent distinct flows, possibly occurring at long intervals of time and perhaps originating from different sources, as adjacent strata often vary widely in color, hardness, texture and porosity. The general lava region of which this is a part covers an immense area, including a considerable portion of Oregon and Washington and adjacent states, and the deposits are of immense thickness. The Deschutes River has cut about 2500 ft. through successive sheets of lava without having exposed the original underlying rock. The same is true of the Columbia River along the axis of the Cascade Mountains, where a canyon about 3000 to 4000 ft. deep has been cut into the anticlinal fold of lava sheets which forms this range.

Although not so evident in the immediate neighborhood of the proposed power site, yet it is not uncommon in some portions of this same general lava area to find large beds of gravel, sand and other poorly cemented sediments between adjacent lava flows and indicating the lapse of a considerable period of time between their deposition. The foundation ex-

cavations of engineering structures in this territory have, at least in some instances, been known to pierce what was supposed to have been basalt extending indefinitely downward, with the result that loose uncemented sediments, unsatisfactory for foundation purposes were encountered. This known treacherous structure of the lava region makes necessary the determination by core borings of foundation conditions prior to the construction of works for which rigid requirements as to impermeability or high foundation pressure are exacted.

This region has been the scene of intense geological action subsequent to the deposition and cooling of these extensive lava beds. There must first have been a subsidence of much of the lava region below the sea, as it is capped in many places with marine sediments; then came the uplift of the Cascade Range which proceeded more rapidly at one time than the cutting down of the Columbia River and created a great inland fresh water sea. The upper strata of the low mountains adjacent to the power site consist of sediments deposited at that time. The uplift of the Cascades appears to have ceased in recent epochs, which permitted the river to nearly catch up in its erosive action and to almost completely remove this barrier.

As one travels up the river from Portland, radical variations in the character of the river channel at different points are to be observed. For the most part the river is broad and sluggish and bounded by immense sand-bars and dunes, more or less completely submerged during floods. At intervals along the river are rapids where it would at first appear that the river bed had resisted erosion and remained at a higher elevation than either immediately upstream or downstream. Some of these obstructions are found at Cascade Locks, Lyle, Three, Five and Ten Mile Rapids above The Dalles, Celilo, Hellgate, and elsewhere further up. At most of these places the river valley is as a rule unchanged in width, indicating that the rapids were not caused by lateral restriction of the channel. The only apparent difference is that the river either flows swiftly through one or more deep, narrow channels cut into a nearly horizontal area of exposed basaltic rock, or flows in shallow depth swiftly over these broad areas of rock, many crags of which may be seen projecting upward through the water. That the river could have eroded a valley of nearly uniform width and then suddenly have encountered on its bed a harder surface of rock which resisted erosion while the channel immediately above and below continued to erode, is conceivable only so long as these latter portions of the river remained swift enough to erode. The fact that the river bed in the stretches between these rapids is now for the most part covered with a deep blanket of sediment precludes the possibility that their beds were cut under present channel conditions.

The origin of the obstruction causing Five Mile Rapids, the site of the proposed development, is plainly evident. Without having locally studied the structure of the other obstructions one may nevertheless assert that in all probability most of them have the same cause, namely, a faulting of the rock strata across the river bed and the consequent elevation of fault blocks above the natural stream bed to dam up the river, causing rapids over them and slack water above them where sediments may accumulate due to the low velocity. This condition is indicated in an ideal, sketch, Fig. 2 (issue of Nov. 13.)

It is with the faulting action which created the topography at the power site that we are particularly concerned. Immediately above the damsite the river flows over and between deposits of sand and gravel with a low water width of about 1800 ft. Across this wide sluggish stream at the damsite a vertical basalt cliff, shown in plate II, rises suddenly to a height of about 75 ft. above the low water level and extends nearly in a straight line across the river and the valley to the northward at an approximate right angle to the channel, until it is lost in the eroded slope of the Klickitat Mountains.

A geological section along the line of the proposed power canal from the damsite to the power house site at Big Eddy, about one and one-half miles, is shown in Fig. 3. Going down the canal line from the damsite a succession of vertical cliffs of varying heights are encountered, each being the face of a distinct lava flow. Between these cliffs the surfaces of the respective flows dip nearly in the direction of the river with a grade of about three per cent. The escarpment at the damsite is two miles or more in length but a width of only about one-half mile, or about the normal width of the river bed elsewhere in this vicinity, has been eroded to its present level. The remainder of the escarpment to the right of the river still has its original crest elevation of about 350 ft.

In Fig. 3 the individual strata are shown by dotted lines, restored to their position immediately subsequent to the faulting action. It will be seen that the total displacement was about 325 ft., and that the river must have been damned and raised this amount if we may assume the entire displacement to have occurred in a short period of time, (which however is improbable), creating an immense inland lake which would have flooded the low benches in the neighborhood of Umatilla, assuming similar topography to have existed there at that time. The backwater from this great dam if restored at the present time would extend to the neighborhood of Pasco, nearly 15 miles above the damsite. The stepped effect along the canal line is the result of subsequent erosion which has removed successive lava sheets from the crest of this natural dam over a width of about one-half mile until the general profile of the natural bed shown in Fig. 3 has resulted. As would also be expected, the line of deepest channel or thread of the stream has eroded more rapidly than the remainder, until a deep narrow gorge has been cut through the entire obstruction and within which the stream at low water is entirely confined, overflowing the benches which formerly formed its bed only in flood stages.

The progress of this action is indicated approximately by the four cross-sections at the right in Fig. 3—one of the original channel, now represented by the present channel just upstream from the fault plane, one of the crest of the fault block immediately after faulting, one of a later stage just as the river began to concentrate its erosive effort upon the present narrow gorge, and one of the present channel just

downstream from the fault plane. The same lava sheets, similar to the profile in Fig. 3, are easily identified on each side of the deep gorge and are exactly conformable on the two sides, thus indicating that there has been no faulting along the axis of this gorge, to which action its existence has at times been ascribed.

**Soundings at damsite.** Referring again to Fig. 9, (See p. 394 Nov. 20th issue of this journal), the place chosen for the damsite is at the narrow neck where the river first enters the gorge, or at the upper end of what is known as "Five Mile Rapids."

Soundings were made here in 1902 and 1903 by W. E. Morris, for a report by the Corps of Engineers, U.S.A., upon the possibility of damming the river at this point for the improvement of navigation. Contours interpolated as accurately as practicable from these soundings are shown in Fig. 10, with a contour interval of 10 ft. It will be noted that the water approaches the neck from the wide section in a funnel shaped channel narrowing to about 150 ft. and deepening as it progresses. This narrow channel continues for a distance of about 250 ft. with a maximum depth of 95 ft., again widening and continuing to deepen as it enters a pool about 300 ft. wide and with general depth at low water of about 140 ft. and maximum depth of about 170. Below this pool the bottom again rises and the channel contracts in width.

The origin of the deep pool immediately below the fault line is a matter requiring some study to determine whether or not the river bottom immediately downstream from the neck is composed of a softer, more readily eroded material. It is a well known fact that water flowing in parallel lines over a smooth surface, even though containing some sediment, erodes very slowly. In case, however, of an initial pit or other depression in a concrete or metal surface, a very violent agitation of the water in this pit occurs as the stream passes over it. Any sediment, sand or gravel in the water instead of sliding over the surface with little or no pressure is thrown violently from one side to the other of the pit and strikes the sides with high velocity and momentum, producing instead of a sliding friction a severe blow to the material. Thus a rough surface becomes rapidly rougher, due to the erosion of flowing water, whereas a smooth surface is very little affected. The same relative erosive power also exists between water flowing in parallel lines over a smooth surface and water violently agitated or eddying in the course of its flow across this same surface.

Water passing over a spillway dam flows usually with smooth even motion until it reaches the tailwater pool, at which point its kinetic energy is converted from the state of parallel flow to the state of violent agitation and eddies. The crest and downstream slope of the dam are little affected by erosion, whereas the provision of an apron below the dam of sufficient durability to resist the destructive effect of the eddies and agitation of the water is one of the most serious problems in the design and construction of a dam.

This in general represents the condition maintaining at the proposed damsite. The water in approaching the neck from the broad river above flows in converging lines in the funnel shaped channel, gradually accelerating until it reaches the narrowest portion, where it is still smooth and its parallel flow apparently little disturbed. Due to the extreme roughness of the bottom this uniformity of flow is gradually broken up until by the time the stream has reached the distance about 200 to 250 ft. below this point, it has become a surging foaming mass with several large permanent eddies.

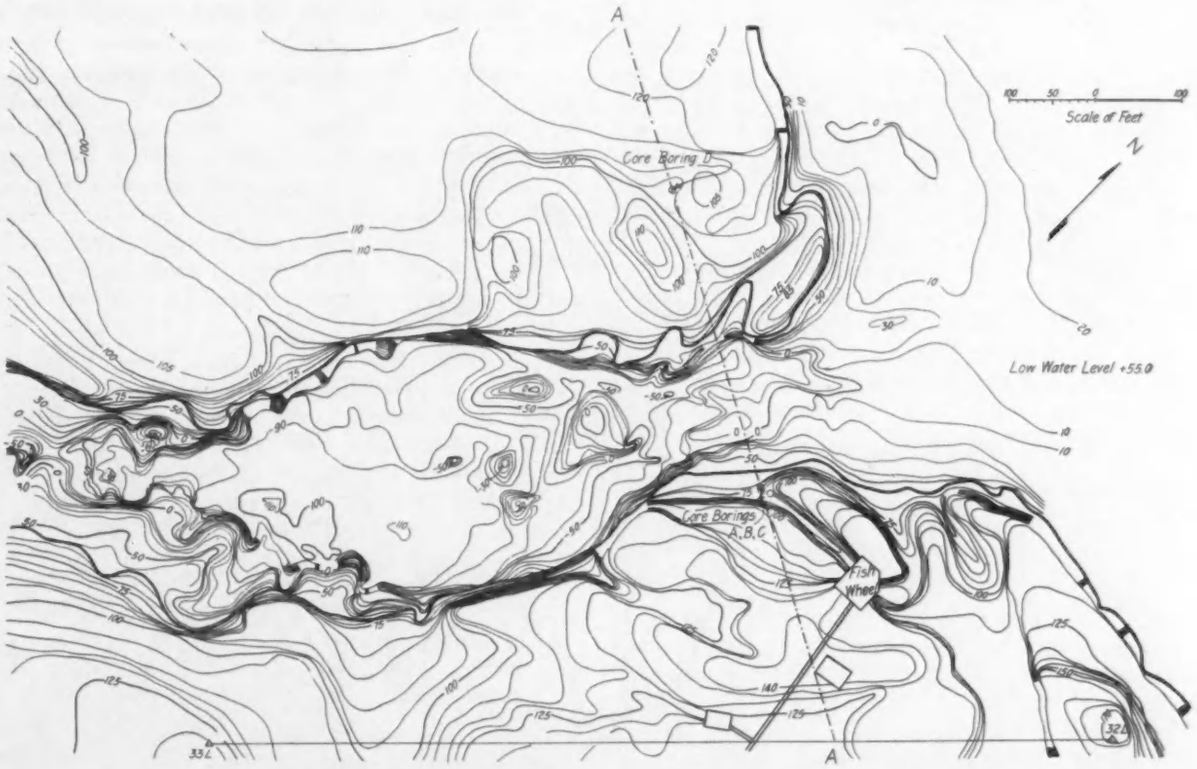



**Fig. 10. Land and Subaqueous Topography at the Damsite, also showing Location of Core Borings.**

Without further knowledge of the situation it is fully to be expected that in case the water originally suffered a fall of a few feet across the crest of the fault block so as to acquire a considerable momentum, the channel immediately below this crest would be affected by a much greater and more rapid erosion and the existing pool would result. This condition might also have been accentuated by the original existence of a depression or pit over which the water flowed, which would have caused a violent disturbance of the parallel lines of flow of the water and would have caused an excessive erosion even though no appreciable fall occurred, the action being similar to that caused by water flowing over any pit or depression as previously discussed.

In reality the fall which takes place under present conditions from the wide river above to the pool in question varies from perhaps 1 ft. in low stage to about 12 ft. in high stage, and the destructive effect under the latter condition is no doubt very great. It is therefore believed that the creation of the pool is a natural consequence of stream erosion and that it does not necessarily signify the existence of unsound foundation material at this point.

**Core borings at damsite.** Four diamond drill core borings were made at the damsite to determine the structure and quality of the underlying basalt and to ascertain as nearly as possible with the small fund available, whether or not the underlying lava flows might be interstratified with deposits of gravel and sand as sometimes occurs. On the map shown in Fig. 10 the line marked "AA" is the line along which core borings were made. Fig. 11 shows a profile of the river along the line "AA" showing the position of all core borings at the damsite with reference to the river cross-section. The several borings are described by the following table:

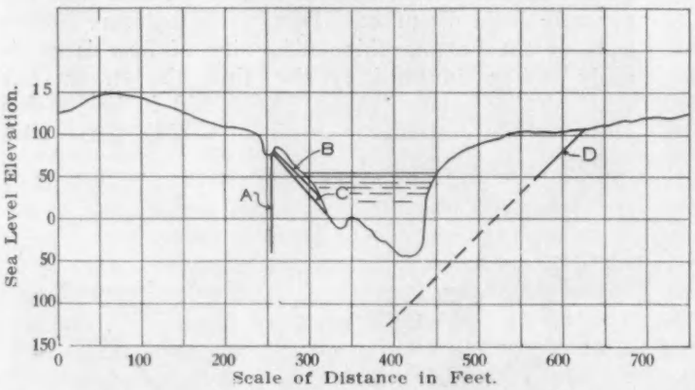



Fig. 11. Cross Section of River at Damsite, showing Core Borings.

| Boring Designation Fig. 11. | Elevation Top of Hole. | Inclination to Vertical. | Depth of Hole. | Elevation of Bottom. |
|---|---|---|---|---|
| A | 76.58 | vertical | 117.5 | —40.9 |
| B | 80.57 | 42° 50′ | 77.0 | 24.1 |
| C | 77.5 | 38° 41′ | 94.0 | 4.2 |
| D | 103.5 | 45° 00′ | 85.0 | 43.4 |

Holes A, B and C were drilled with hand drills taking a core fifteen-sixteenths of an inch in diameter; Hole D was drilled with a steam drill taking a core of the same size.

Vertical hole A and inclined hole B were drilled simultaneously from the bottom of the tailrace channel of Fishwheel No. 5. It was expected from a study of the soundings that hole B would pass underneath the bed of the river. The hole, however was drilled too close to the platted position of the river bed to allow for the extreme irregularity of the bottom, which, together with the inaccuracy with which the contours could be interpolated from isolated surroundings on such a bottom, was not fully appreciated at the time and the hole ran out into the river at the depth shown. Another hole, C, at a steeper angle and a few feet back was then started but also ran into the river, at a somewhat greater depth, however.

It was then evident that the soundings had been misinterpreted and that the hole could not be put under the channel from the fishway at an inclination to the vertical sufficient to make it of much more value than a vertical hole. To have drilled a hole from a point far enough back upon the bluff would have entailed a large expense.

In the meantime, the geological structure of the power site, previously described, had been worked out and some significant facts had been collected relating to the strata pierced by other wells in the neighborhood. The U. S. Engineers, for a water supply for the construction work of the Celilo Canal, drilled a 4-in. well in 1911 at a point about 500 ft. to the left of the centerline of the river and 500 ft. downstream from the damsite. This well has a top elevation of about 145 ft. and bottom elevation of minus 106 ft., which is nearly as deep as the deepest hole (minus 115 ft.) in the pool downstream from the damsite. Nothing but basalt was encountered without interstratified sand or gravel.

Two other wells were drilled by the U. S. Engineers, one near Big Eddy on the Oregon side, having a depth of 119 ft., and the other about 2 miles above the damsite, having a depth of 208 ft. All of these holes indicated nothing but basalt without intrastatified sediments.

Mr. F. A. Seufert about ten years ago put down a core boring at a point about one mile upstream from The Dalles and another about three miles downstream, both near the river on the Oregon side. These holes both passed through a depth of about 836 ft. of basalt and then ran into a bed of clay about 42 ft. thick, again entering basalt and continuing to a depth of 1003 ft., where they were both abandoned. Both holes indicated solid basalt without sediments except for clay strata mentioned.

Mr. F. L. Kretzer has drilled a hole 1700 ft. deep about one or two miles west of The Dalles. The upper 720 ft. of this hole was drilled with a drop bit; the remainder of the hole was drilled with a diamond core drill, and indicated no sediments except in the neighborhood of 1200 to 1400 ft. in depth where a few feet of sandstone and shale cores were apparently obtained.

Based upon the records of these holes and the core borings already made it seemed fairly certain that the successive lava flows entering into the rock structure at this place occurred either at short intervals of time or upon flat or high areas which prevented the accumulation of sediments between the strata. The contacts between successive lava flows outcropping in the adjacent bluffs also tend to corroborate this conclusion. Upon this showing, combined with the fact

that a rockfill dam only was contemplated at that time, the bearings were discontinued on May 20, 1914.

In the latter part of August it was decided to make another boring, this time upon the Washington side. Drill equipment, in this case steam operated, was therefore assembled and actual drilling started on September 12, 1914. The hole was discontinued on September 29, at a depth of 85 ft., because of lack of funds.

In some of these holes, especially above the low water level in the river, occasional open seams were encountered from one to several inches in depth and sometimes containing sand. At these places the drill water usually stopped returning to the surface, and manure or other calking material was forced into the holes until the leak was stopped and the water again returned. The small size of these seams and the fact of the loss of the drill water indicated that they were the channels of springs finding their way through crevices in the rock from higher elevations to the river level, such as are almost universally encountered in all rock, and were not indicative of any general interstratified sediments.

Some of the basalt strata both as observed in the outcrop and as indicated by the cores, are of massive columnar structure, giving long cores. Other strata have a shattered and irregular appearance, the cores coming out badly broken into short pieces, the ends of which indicate natural seams. All cores taken out at the damsite were free from the gas bubble holes so common to the lava elsewhere and evident in some of the overlying strata shown in Fig. 3, now eroded away at the damsite.

**Core borings at power house site.** One vertical diamond drill core boring was bored by hand drill on the Washington shore of Big Eddy at the proposed power house site at the location shown in Fig. 9. The elevation of the top was 96.3 ft., depth 139 ft., and elevation of the bottom minus 42.7 ft.

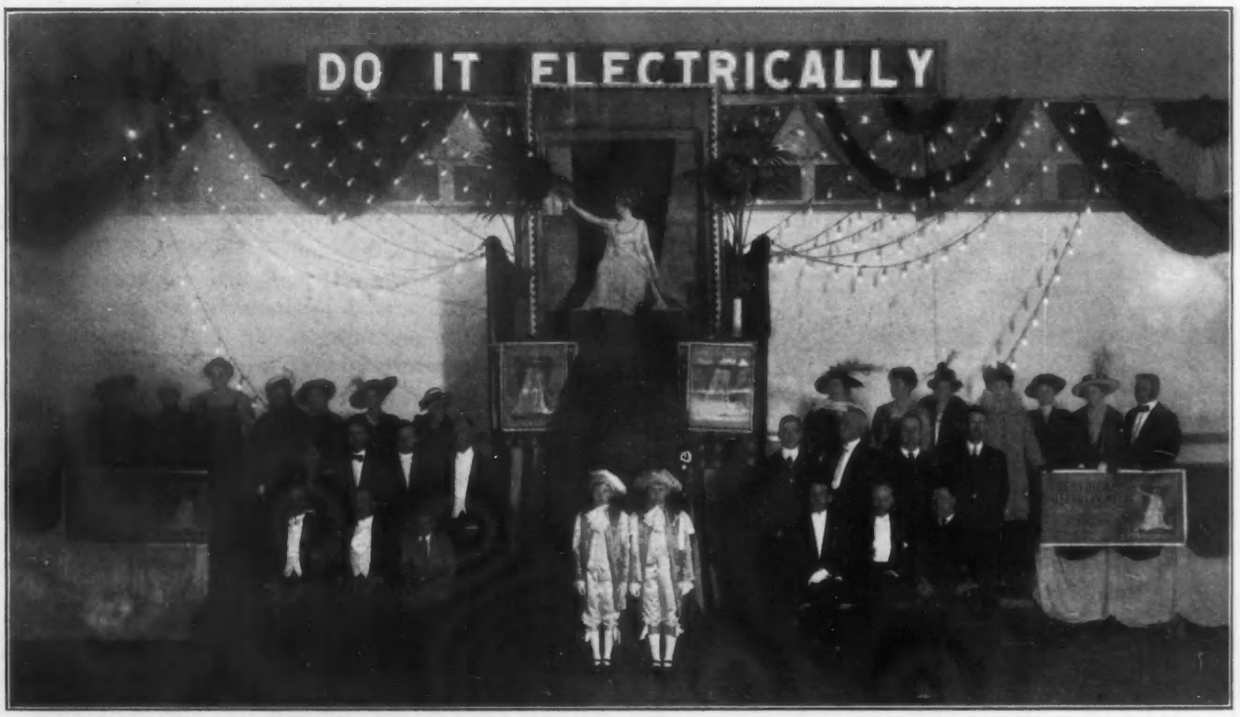
The lava strata which were here penetrated were much softer than those at the damsite, as indicated by the rapidity of boring and the wear on carbons and bits. From Fig. 3 it will be seen that, due to the downstream dip of the lava sheets, these strata are the ones overlying the rock at the damsite and the ones which would be chiefly excavated in cutting the canal.

**Conclusions as to foundation material.** The geological structure shown by surface indications, by core borings and wells previously drilled, and by core borings drilled as a part of this investigation, are assuring as to the satisfactory nature of foundation materials for any types of structures likely to be built.

## PICTURES OF ELECTRICAL PROSPERITY WEEK FEATURES AT SAN FRANCISCO

Gas & Electric Appliance Company's Window.

"Electra" Figure operated switch, turning on and off lighting effects. "Chase the Chill" figure operated by motor. Junior electric range cooked meat, vegetables and biscuits shown in front of oven.




Electrical Boxes at Prosperity Ball, Civic Auditorium, San Francisco, Dec. 1, 1915, with Miss Alta Loraine Hellar as the Goddess Electra.

# JOURNAL OF ELECTRICITY
## POWER AND GAS

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**Legalizing the Boiler Code**

"Safety first" has become a slogan which has reverberated through the proceedings of all the great engineering societies during the current year. The recent Boiler Code of the American Society of Mechanical Engineers has now made it possible to build better and safer boilers than have ever before been constructed. While standardization of factors of safety in boiler construction perhaps marks the greatest achievement in this work, still the uniform methods of inspection and testing set forth are most helpful, to say nothing of countless details that are given for the designing of various types of shell and rivet joints.

Eleven great engineering societies have now adopted this code officially and a concerted effort is being made to have all boiler specifications made according to the American Society Code and as soon as possible to make this code the common law of the United States on boilers.

California, Pennsylvania and Wisconsin have already accepted the code. During the current year bills will be introduced into the legislatures of ten other states. The subject merits the hearty co-operation of all engineers and others interested in safe and efficient power generation.

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**Vocational Guidance**

Much has been done by the national engineering societies looking toward the promotion of engineering and vocational education, but little his been accomplished in gathering data and statistics that might lead the engineer into broader paths of usefulness. Though so trained that his mind might well be diverted into paths which would vastly assist in the solving of many commercial, industrial and political problems, the engineer still largely confines his endeavors to purey technical phases of the engineering profession.

So long as this narrow viewpoint prevails in the engineering profession so long will periods of financial retrenchment find him either embarrassed in the practice of his profession or completely without employment.

The most helpful thing that could be devised to alleviate this pressing condition would be the appointment of a joint committee of national engineering societies to analyze this particular phase of engineering betterment. The labors of such a committee would undoubtedly result in unifying and broadening engineering aspirations, in assisting in engineering advancement and vastly simplifying the question of "what is an engineer?"

Much is being said nowadays about vocational guidance. Here is a means that could be employed to go to the bottom of this perplexing question which would undoubtedly result in materially stabilizing the engineering profession, no matter what the financial stresses might be. The problem is one that cuts at the very roots of engineering progress and it should receive early and thoughtful consideration by all interested in engineering advancement and betterment.

**Underground Waters**

A score of years ago it was not uncommon to find even in fairly intelligent communities of the West a more or less superstitious belief in the mystic powers of the so-called "water witch," who with his magic willow switch was supposed to be able to predict the location of underground waters.

Recent investigations show, however, that underground waters are not a matter of mystery but indeed are so natural in their laws of flow and storage that measurements may be made and checked within ten per cent. The important part of the findings is, however, that which goes to show that each individual well is linked to all other individual wells in the same underground basin and that the underground basin as a whole has a more or less definite relationship to the flow of surface waters in that basin. Hence it is seen that the legislative control of surface waters only touches a small part of the problem of water conservation and adjudication.

Indeed the amazing growth in utilization of underground waters is a subject that justly merits careful consideration. From data published by the irrigation investigations office of experiment stations, United States Department of Agriculture, and from the report of co-operative irrigation investigations in California by the California Department of Engineering, it is seen that in 1914 there were 24,589 pumping plants in California, or more than two and one-half times as many as in existence in that commonwealth just five years previous. To such proportions has this utilization of underground waters grown that now it is estimated that twenty-two per cent of the irrigated lands of California are supplied from underground sources. And of course the underground waters used for domestic, manufacturing and general municipal purposes would vastly swell this percentage. The same growing uses for these waters are to be found in Washington, Oregon and other Western commonwealths.

Since, then, this matter is one of vast economic importance, Western states would do well to revise and remodel such water commissions as they may have in force, giving to such officers full powers not alone in dealing with surface flow but with underground waters as well.

A technical staff should also be created under the direction of the water commission to gather further data on the intimate relationship that is now known to exist between surface and ground water supplies. This technical staff should also be prepared to give scientific advice, based on painstaking research, as to the wisdom of curbing overdraft of water or the capping of artesian discharges as well as taking definite steps to avoid losses by evaporation of underground storage. Developers, too, need advice as to the probable yield from a proposed underground storage basin in order to prevent waste of money and to scientifically compute the ultimate uses to which arid lands may be put.

The gathering of such information requires knowledge of conditions over large areas and over extended periods of time and it furthermore requires co-operation on the part of local people, such as drillers of wells, users of water and water companies. Thus the problem of underground waters is seen to have grown in a brief score of years from the mystery of the willow switch to one that involves practically every phase of domestic and economic life in which the question of water supply enters.

Its importance should not longer be overlooked. And the only way to prevent its being overlooked is to put it in the care of a highly scientific commission with power and money to act.

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**Circulating Engineering Libraries**

One of the most striking features of public utility evolution is the mutual personal helpfulness that is shown in the corporation management from the chief down to his humblest assistant. This all pervading spirit has developed a corporation loyalty that in many instances departs from the cold indifference of former days to approach more that of filial devotion on the part of the humbler and less advanced groups toward those in authority, and a kindly paternal interest on the part of the chiefs.

Perhaps the spirit that has been shown on the part of the superior to assist the beginner by free and open explanations of corporation policy and technical study has had more to do with this promotion of mutual helpfulness than any other one thing. The under man thus feels that he is part and parcel of the corporation welfare and protection and that the corporation has a personal interest in seeing that every useful trait in his makeup be developed, for thereby is the efficiency of the corporation increased. So various and far-reaching have become the individual activities of utility life that each individual member must become a highly specialized unit in himself in addition to knowing general technical subjects necessary in the corporation life and activity as a whole.

Several corporations of the West have recently hit upon the plan of devising technical libraries that are of assistance to various groups in the different cities and communities where its service has extended. A main librarian sees to it that the separate libraries are kept circulating among groups where their usefulness is most needed. Duplication of books is thus avoided and it is wonderful what interest and enthusiasm is aroused by proper planning in the selection of books by taking account of the needs of those to whom they are to go.

For the more select work the state universities have been appealed to through their extensive departments to assist in furnishing books and subject matter for discussion.

On this enlarged basis the subject thus becomes one of organized university extension and through the co-operation of corporation managers the entire matter becomes one of interest, enthusiasm and mutual helpfulness.

Practically any range of technical subject matter thus becomes available and in instances where it is desirable to organize extension courses under university direction a feasible plan is thus open for use.

The scheme is to be highly commended and it is believed that in those western states where corporation technical life is thus linked up with educational effort both of the corporation and of the state, that tremendous opportunities for development and increased efficiency are thus made possible.

# PERSONALS

**Clem A. Copeland** is at San Francisco from Chicago.

**H. Wallace** of the firm of Wallace & Smith, electrical contractors, Lodi, Cal., was a recent visitor at San Francisco.

**F. N. Averill,** manager Fobes Supply Company at Portland, is at San Francisco.

**T. E. Burger,** Western Electric representative, Los Angeles, Cal., spent a few days at San Francisco during the week.

**W. S. Heger, Jr.,** of the Busch-Sulzer Diesel Engine Company at San Francisco, just returned after a six weeks' business trip throughout Nevada.

**K. E. Van Kuren,** representative of Westinghouse Electric & Manufacturing Company, Los Angeles, Cal., spent a few days at San Francisco during the week.

**S. V. Walton,** commercial manager Pacific Gas & Electric Company, attended the meeting of the Pacific Coast Electrical Supply Jobbers' Association at Del Monte this week.

**Miley Johnson** and **Frank Gengler,** electrical men of Marysville, Cal., have formed a partnership and entered the electrical dealing and contracting business in that town.

**Geo. J. Henry, Jr.,** hydraulic and mechanical engineer of San Francisco, has just returned after spending two months on a business and pleasure trip throughout the Southwest.

**W. M. Deming,** supply department of the General Electric Company, who has been spending the past two months on the Pacific Coast, recently left for the home office at Schenectady, N. Y.

**A. O. Austin,** chief engineer of the Ohio Brass Company, Mansfield, Ohio; **J. E. Crilly,** of the San Francisco office, and **H. C. McCutchan,** of the Los Angeles office, just left on a business trip in the East.

**H. E. Chener,** district manager of the Chicago office of the Wagner Electric Manufacturing Company, has just been appointed supervisor of the sales organization of that company for the United States.

**W. H. Leffingwell,** electrical engineer of Bishop, Cal., spent the past week at San Francisco. Mr. Leffingwell is exceedingly optimistic as to the future of the electrical industry in his section of the country.

**R. H. Hudson,** manager of the Los Angeles office of the Pierson, Roeding Company, and **N. H. Silver,** manager of the Seattle office, have been visiting San Francisco and have returned to their respective offices.

**James R. Harris,** vice-president and general manager of the Busch-Sulzer Diesel Engine Company of St. Louis, Mo., has just returned East after spending a few weeks on the coast and congratulated Mr. Heger for the good work he has done with their exhibit at the Fair.

**R. J. Behan,** of the Westinghouse Electric & Manufacturing Company, San Francisco, and **S. H. Taylor,** of the Electric, Railway & Mfrs. Supply Company, San Francisco, who have been making a business trip through the East for the past several weeks, returned the latter part of the week by way of San Diego and Los Angeles.

**A. J. Turner,** engineer in charge of construction of the Washington Water Power Company, Spokane, Wash., has been in San Francisco for the past week to witness the close of the Exposition. He also intends to visit the San Diego Exposition and remain in California for a considerable time. As construction engineer of the Washington Water Power Company he had direct charge of the 25,000 kw. plant at Little Falls, Wash., and has just completed the 50,000 kw. plant at Long Lake, Wash.

**E. W. Rice, Jr.,** president of the General Electric Company, was the guest of honor at a directors' luncheon in the California building at the Panama-Pacific International Exposition last week. The speakers were: President Charles C. Moore, E. W. Rice, Jr., R. B. Hale, Arthur Arlett, W. D'A. Ryan, Dr. Thomas Addison and O. D. Young. W. M. Deming, W. J. Davis, T. E. Bibbins, Elgin Stoddard, J. J. Clark, W. H. McLaren, E. C. Luskin, C. H. Gaunt, J. J. Avis, Mortimer Fleishhacker, Charles S. Fee, H. D. H. Connick, G. L. Bayley, A. F. Dickerson, Captain Edward Carpenter, U. S. A., L. F. Leurey, Theodore Hardee, Lieutenant-Commander Clark H. Woodward, U. S. N., and J. M. Cumming were also present.

## MEETING NOTICES.

### California Association of Electrical Inspectors.

A meeting of this association will be held Saturday, December 11, 1915, at 2 o'clock p.m., in the rooms of the Board of Fire Underwriters of the Pacific, 914 Merchants' Exchange Building, San Francisco, for the purpose of discussing the changes in the National Electrical Code. All persons interested in inspection work are urged to attend this meeting.

### Jovian Electrical League of Southern California

Electrical Prosperity Week was fittingly celebrated by the Los Angeles Jovians by an electrically prepared luncheon served to about 400 persons, in the Times assembly rooms, on Wednesday, December 1. As it was Ladies' Day, the meal was prepared under the direction of Mrs. Eva Scott and served by handsome damsels, and even the speaker of the day was a woman, Miss Grace Fulmer, assistant superintendent of the Los Angeles public schools. Tribune Henry Holland presided in his customary snappy style. Miss Grace Fulmer gave a most interesting and instructive talk on "Shall We Believe in Myths and Fairy Tales?"

## OBITUARY.

**James I. Ayer,** manager of the Simplex Electric Heating Company, Cambridge, Mass., and one of the pioneers in the electric cooking and heating industry, died at his home in that city November 26. Death was caused by heart failure, and was very sudden. Mr. Ayer having been at his office earlier the same day. Two years ago he suffered from a severe illness, but had apparently completely recovered his normal health. Mr. Ayer was born in Medford, Mass., in 1854. His business career in electrical appliances began in 1896, when he manufactured electrical heating devices in a small building at Cambridge. His associates, who had become discouraged at the slow progress of the industry and the tardiness with which the public took up the devices, left Mr. Ayer to pursue his chosen field alone. By persistence and determination he overcame all obstacles and built up a business which is one of the largest and most successful of the kind in the country. He was a member of the Engineers' Club, Boston, and past president of the National Electric Light Association. Three daughters survive, besides the widow.

## NEW CATALOUGES.

Westinghouse Electric & Manufacturing Company has issued a leaflet showing their complete line of small motors. Their application is told by picture and text.

"A Simple but Important Problem" is the title of a striking pamphlet from the Westinghouse Lamp Company giving pointers on store lighting for merchants.

Bulletin No. 540-1 from Standard Underground Cable Company illustrates and describes Standard Motor Cables for motor cars, boats, cycles, aeroplanes and gas engines.

Battery Charging Equipment is the title of Booklet B, a 16-page booklet just published by The Cutler-Hammer Manufacturing Company of Milwaukee. The types of equipment described include the well known Universal Unit type for large fleets and public garages; panels and rheostats for individual vehicle charging; and rheostats for charging batteries used on starting, lighting and ignition systems of gasoline cars. The H. B. Squires Company of San Francisco, Cal., Portland, Oregon, and Los Angeles, Cal., are representatives of The Cutler-Hammer Company.

## J. G. BRILL COMPANY-PIERSON, ROEDING & COMPANY ANNOUNCEMENT.

The J. G. Brill Company, of Philadelphia, and Pierson, Roeding & Company, of San Francisco, have just announced the termination of the Pacific Coast sales agency for the sale of electric railway cars and trucks, held by the latter for many years past. This successful and very satisfactory association was discontinued only after a very thorough consideration by both parties with respect to their future policies in the Pacfic Coast territory.

Pierson, Roeding & Company have decided to confine their efforts hereafter more particularly to the sale of electric power transmission materials and appartus used in connection with hydroelectric developments, underground conduit systems and railway signalling, although as heretofore, they will continue the sale of overhead and track materials for electric street and interurban railways.

The J. G. Brill Company and its constituent companies will extend their own sales organization to cover the Pacific Coast territory. Mr. F. A. Richards, who has had charge of the car and truck department of Pierson, Roeding & Company for the past six years, has been appointed Pacific Coast manager for the Brill interests, with offices at 907 Monadnock building, San Francisco.

## CLOSING OF THE BUSCH-SULZER BROS.-DIESEL ENGINE EXHIBIT.

The great Diesel engine, which officially started at the P. P. I. E. on Opening Day by President Wilson from a wireless key in his office at Washington, D. C., was stopped by President Moore after ten months' operation by the use of a wireless transformer.

The Busch-Sulzer Bros.-Diesel Engine Company engaged the services of the Naval Training Station Band from Yerba Buena Island for the closing ceremonies and as the engine died down, two buglers standing on the engine platform blew "Taps." This Diesel engine has been in continuous operation on Fair schedule since opening day, and was awarded the Grand Prize. The exhibit also received the Departmental Gold Medal, of which only nine were given—one for each department having the best, most attractive and most handsome exhibit.

Tangible returns, independent of the great educational features the Exposition was built for, were received by this company in the shape of five sales of engines of various sizes, including the engine on exhibit. The exhibit was also favorably commented upon by Messrs. Ford and Edison while here on their visit, as well as having received much complimentary notice from Dr. Ritter, Minister from Switzerland, and other notables.

## NEWS OF WASHINGTON PUBLIC SERVICE COMMISSION.

The field engineers who have been engaged for the past several months in gathering data on the physical valuation of the Washington Water Power Company, have completed their task and the work of summarizing the results will be done in Olympia. The valuation of this plant in the states of Washington and Idaho, which has been accomplished by the public service commissions of Washington and Idaho, working jointly, is the biggest hydroelectric valuation ever undertaken in the United States. This compilation work will probably be finished about January 1, after which the commissioners will start making their rate survey, so a formal hearing for the purpose of fixing a fair valuation and prescribing rates which will net a fair return on the investment will probably not be called until late in the spring. The commission undertook the three largest tasks of its career when it undertook the physical valuation of the Washington Water Power Company, the telephone lines in the state and the Puget Sound Traction, Light & Power Company. The last named job has been halted, temporarily at least, but the other two will be continued.

## CHANGES IN THE NATIONAL ELECTRICAL CODE.

BY C. W. MITCHELL AND G. A. CLEARY.

The 1915 edition of the National Electrical Code contains various changes and additions to rules, the principal ones of which are given below. On account of the delay in publication of this Code, it has been deemed advisable by the Board of Fire Underwriters of the Pacific to postpone the adoption of these regulations until January 15, 1916.

One of the most important changes is that in the specifications for coverings on rubber covered wires. All single conductor rubber insulated wires and cables must have a covering of fibrous material applied directly to the surface of the insulating wall.

For any single conductor wire there shall be at least one braid for sizes from No. 14 to and including No. 8. For all single conductor cables larger than No. 8 there must be two braids or a tape and a braid.

For twin wires and twisted pair wires and for all multiple conductor cables there shall be a fibrous covering on each individual wire and in addition a braid enclosing the bunched conductors.

Fibrous coverings may be either braid or tape but tape shall not be used for the outer covering. All braids must be impregnated with a moisture-proof compound.

References are made to the coverings required for wires to be used in various classes of construction in the installation rules such as 26 g, k, n, and q.

Other principal changes are given with the section and rule numbers under which they may be found in the Code:

1-c, second paragraph. Requires grounding of base frames on generators operating at a potential of 550 volts or less.

2-a, second paragraph. Requires grounding of lead sheath or conduit on cables from generator to switchboard where protection against moisture is necessary.

8-a, second paragraph. Requires grounding of base frames on motors operating at a potential of 550 volts or less.

8-b, second paragraph. Provides for protection of high tension motor circuits.

8-b, fourth paragraph. Changes in percentage of current rating of motors for various classifications of service.

8-c, first paragraph. Increases size of fuses from 6 to 10 amperes, and limits circuit to 660 watts for groups of small motors.

8-c, fifth paragraph. Additional data on time limit circuit breakers and conductors on a.c. motor circuits.

11-b, second paragraph. Requires grounding of cases or frames of transformers used exclusively to supply current to switchboard instruments.

12-b, first paragraph. Provides rules for installation of multiple conductor line wires.

12-c. Increases height at which wires must clear roof of buildings.

12-f. Four paragraphs added which cover the installation and grounding of conduits containing service wires.

12-h. Specifies distance of 500 ft. between ground connections on metallic sheaths of cables.

14-a-2. Addition which provides for grounding neutral wire of underground d.c. three-wire systems on the individual services.

16-b, first paragraph. That part of rule which required use of solid knobs at the end of runs has been stricken out.

16-h. New section added which specifies size of neutral in three-wire (not three-phase) systems.

17-d. Addition to this section which specifies methods of installation of underground services.

19-b, second paragraph. Cabinets and cut-out boxes must be of metal when used with metal conduit, armored cable, or metal moulding systems.

19-c. Switches, cut-outs, circuit breakers, etc., must be mounted in approved cut-out boxes or cabinets when located where exposed to moisture as in basements and similar places. When located in wet places or outside of buildings must be mounted in approved "weatherproof" cut-out boxes or cabinets.

19-d. Transformers, cut-outs and flashers and other similar devices for signs must be enclosed in approved cut-out boxes or cabinets except as specified in rules for construction of signs.

19-e. New section which specifies spacing required between line parts of switches, etc., and walls of cabinets.

23-a, second paragraph. Addition which permits installation of service switch of knife-blade type, if enclosed in an approved box or cabinet, between service cut-out and source of supply.

23-a, third paragraph and b, second paragraph. Additions which provide that cut-outs must not be placed in any permanently grounded wire except in two-wire branch circuits.

23-c, second paragraph. Addition which specifies spacing required between link fuses and walls of cabinets.

23-d, first paragraph. Establishes limit of 25 candelabra sockets or lamp receptacles on a circuit.

23-d, third paragraph. Establishes rating of 25 watts for each socket and lamp receptacles of candelabra size.

23-d, fourth paragraph. New paragraph specifying conditions under which receptacles for attachment plugs may be connected to ordinary branch circuits. A cut-out must be provided for each receptacle rated above 660 watts.

23-e, first and second paragraphs. Additional data on time limit circuit breakers and conductors on a.c. motor circuits.

23-e, third paragraph. New paragraph which provides for the installation of fuses in multiple on circuits of large capacity. This does not apply to motor circuits.

24-a, second paragraph. Addition which provides that service switches must indicate plainly whether they are open or closed.

26-a. This rule has been amended so as to require the use of an approved fitting to secure flexible tubing to a metal cabinet, cut-out box, junction or switch-box.

26-e, second paragraph. Protection of wires on side walls must extend not less than seven feet from the floor. Height was formerly five feet.

26-1. Addition which establishes limit of four No. 14, B. and S. gage rubber covered wires in metal moulding.

26-n, first paragraph. Addition to this rule which states that rubber covered wire for conduit work must be double braided for twin, twisted pair or multiple conductor cables and for all single conductors of No. 6 B. and S. gage and larger.

26-o, first paragraph. Change in method of supporting conductors in vertical conduit risers.

28-g. Defines accessibility with regard to junction boxes in attics.

28-i. Tables of sizes of conduits for the installation of wires and cables.

31-c. Addition to rule intended to prevent opening of circuit at socket where keyless sockets are required.

31-d. New rule which requires that if a socket is not attached to a fixture, the inlet if threaded must be not less than 3-8 in. pipe size, and must be provided with an approved insulating bushing.

31-h. New rule which provides that so-called hard rubber or composition bushings threaded into box covers must not be used where flexible cord passes through covers of outlet boxes.

35-a, b, c and d. New rules governing installation of gas filled incandescent lamps.

38-c, 2. New rule pertaining to installation of dimmers.

38-d, first paragraph. Addition to rule covering installation of footlights.

38-d, second paragraph. Increases number of receptacles for footlights from 26 to 32 per circuit.

38-e, 2. Increases number of receptacles for border and proscenium side lights from 26 to 32 per circuit.

38-u, 7, second paragraph. New paragraph which defines method of ventilating operating rooms of moving picture theatres.

38-v, 1 to 7 inclusive. Change in rules for moving picture equipments of improved miniature type for home, lecture and similar purposes.

48-a to h, inclusive. New rules for installation of wiring and electrical apparatus in garages.

49-57, inclusive. Specifications for the manufacture of wires changed to conform to standards of Underwriters' Laboratories.

53. Permits, for conduit work, the use of single braided rubber covered wire of No. 14 to No. 8, inclusive.

70. Revision of this rule which now defines cabinets and cut-out boxes, giving specifications for their construction and method of mounting devices within them. A distinction is made between those for ordinary use inside and those intended for installation out-of-doors or in wet places.

It is expected that copies of the Code will be ready for distribution about the 20th of this month. They may be obtained by making application to the Board of Fire Underwriters of the Pacific, 914 Merchants' Exchange Building, San Francisco.

## TRADE NOTES.

The Washington State Supreme Court, in the case of the Fobes Supply Company against R. G. Kendrick, has reversed the judgment of the lower court, which found for the plaintiff, and has remanded the case for new trial.

Benjamin B. Lawrence, a member of the class of '78, has purchased the Pelton-Doble water wheel and the Pelton-Francis turbine which were exhibited by this company at the Panama-Pacific International Exposition, and presented them to the Columbia School of Mines.

The Merritt Building at Los Angeles, one of the finest office buildings in the world, constructed of spotless white marble, with marble floors throughout, together with woodwork of the finest mahogany obtainable, is provided with a kitchen and dining room, and a special Simplex range capable of cooking meals for about a dozen people.

This Simplex range is special in some of its features; for instance, it has only two legs. These legs support the front of the range, the back being held up by lag bolts fastened to the side wall of the room. The two legs are in Sheraton style, nickel plated to harmonize with the fittings of the kitchen which are of Greek classic style. This range has the same body dimensions as No. 23K range but the stove equipment consists of two 6 in. stoves, two 8 in. stoves, one 10 in. stove. The oven has working dimensions of 15 in. wide, 18 in. deep, 11½ in. high inside. The plate warmer is 15 in. square and 7 in. high. The broiler is 12 by 18 in. in dimensions, and is on top of the oven and enclosed with a hood which is equipped with a roll cover. The following utensils were furnished with this range: One 0756 blazer, one 0772 double boiler, one 0777 vegetable boiler, one 0763 tea kettle, one 0778 vegetable boiler. The total connected load is about 7½ kilowatts.

# NEWS NOTES

## INCORPORATIONS.

SANTA FE, N. M.—The Rio Grande Light, Heat & Power Company, a Philadelphia concern, has incorporated here. It is capitalized at $1,000,000 to build a dam 112 ft. high in White Rock canyon, 18 miles from Santa Fe. The company proposes to furnish electric power for lighting and industrial purposes to Albuquerque, Santa Fe, Las Vegas and other towns.

## ILLUMINATION.

MILES CITY, MONT.—H. A. Koehler & Company have asked the council for a gas franchise.

CRESCENT CITY, CAL.—V. A. Price has submitted plans to the city council for a municipal electric light plant.

EUGENE, ORE.—The council passed an ordinance providing for lighting of Ninth street between Olive and Pearl streets.

CULBERTSON, MONT.—Donaldson, Bros. will purchase a new engine for electric light plant and large storage battery will be installed.

DENAIR, CAL.—The board of supervisors has called an election to vote on the organization of the Denair Lighting District of Stanislaus County.

FALL BROOK, CAL.—Everett Brandon is working on a plan for the installation of an electric lighting system for the business district of this city.

LOS ANGELES, CAL.—The supervisors will receive bids up to December 13th for the renewal of contracts for street lighting in the Hawthorne and Palms Lighting Districts.

PASADENA, CAL.—A resolution of intention has been adopted by the city council to order the construction and installation of posts, conduits, wires, etc., along Green street.

NILES, CAL.—E. F. Walker has applied for permission to lay gas mains in several streets of this city. He has been given a lease on the gas plant recently installed here by the Union Gas Company.

IDAHO FALLS, IDAHO.—The public utilities commission has received a petition for certificate of public convenience from J. A. Jones and E. G. Kindred for permission to install a gas plant at this place.

GILROY, CAL.—The council has leased the electric lighting plant to the Coast Counties Gas & Electric Company. The company is to remove its poles and wires from Monterey street and install a new electrolier system.

ASHLAND, ORE.—The city has signed a contract with the Oregon-California Power Company looking towards taking over by the city of the light and power equipment within the city limits, the company will sell the energy at wholesale rates to the city.

ST. ANTHONY, IDAHO.—The city council is considering a proposition of installing an ornamental street lighting system on both Bridge and Center streets from the depot to the M. J. Gray corner. Information in regard to the same may be obtained from the city clerk.

SANTA ANA, CAL.—The ornamental lighting district as first proposed for the business district, has been extended from Mortimow to Ross street on Fourth and from Second to Sixth street on Main and Broadway, is also to be included at least from Fourth to Sixth street.

HAILEY, IDAHO.—Ferris Bros. of Wisconsin have purchased the local electric light plant from Frank and Fred Gooding. They are negotiating for the purchase of the Rockwell-White plant at Bellevue. It is said that they plan to consolidate the two plants in case the deal goes through.

WHEATLAND, WYO.—The city council has decided to expend between $6000 and $10,000 for steam equipment at the city light plant. A new steam engine and two boilers will be purchased and bids for the same will be called for at once. It is contemplated also to install a new electric generator in the near future.

RIVERSIDE, CAL.—The common council has taken bids for constructing electric light poles, conduits and lamps on East Fifth street, East Sixth street, East Seventh street, East Eighth street, East Ninth street, Pachappa avenue, Park avenue, High street, Sedgwick avenue, Comer avenue, Eucalyptus avenue, Franklin avenue, Kansas avenue.

MONTICELLO, UTAH.—There are strong indications that the efforts being made to install a water-works system and electric light plant will prove successful. The stockholders of the Blue Mountain Irrigation Company have agreed to finance and install the proposed systems. Information may be obtained from the secretary of the company.

HUNTINGTON BEACH, CAL.—The city trustees have adopted a motion that the proposed issue of bonds for the installation of a municipal gas distributing system be indorsed. The intention is to construct a distributing system and purchase gas from Southern Counties Gas Company, which company has agreed to pipe gas to the city limits.

POCATELLO, IDAHO.—At the last session of the city council further consideration was given to the creation of an improvement district for the purpose of installing ornamental street lighting standards along a number of the city streets. The city engineer estimates that it will require 350 posts to cover the district proposed.

IDAHO FALLS, IDAHO.—W. D. Wilcox of Chicago proposes, to establish a gas plant in Idaho Falls, which, when completed, will represent an expenditure of $175,000. His plan, according to the franchise he has prepared calls for work to begin by June and by October, 1917, there will be 6 miles of mains which will be extended as the demand grows. Mayor Edginton stated that he would call a special election to consider the matter.

CHEYENNE, WYO.—C. A. Semrad, local manager of the Cheyenne Light, Fuel & Power Company, has completed plans and specifications for improvements to the local plant, estimated to cost about $50,000. The plans have been forwarded to the executive committee of the Western Power Company at New York, the parent company. The proposed work involves the installation of a new steam turbine and generator, boiler feed water heater and feed pumps, automatic stokers, etc.

MEDFORD, ORE.—After three years' dispute in which the matter was fought out in the courts in favor of the electric company, the city of Medford and the California-Oregon Power Company finally reached a settlement today whereby the city receives 3 per cent of the gross earnings of the company and a reduction of 50 per cent in the cost of street lighting. Medford, on the other hand, concedes the electric franchise as legal and agrees to pay all back charges for electricity, amounting to several thousand dollars. On this cost bill the company also agreed to deduct nearly $300. A second power company, known as the Rogue River Public Service Corporation, recently applied for a franchise, but with this settlement a second franchise scarcely will be granted.

SALT LAKE CITY, UTAH.—The Utah Power & Light Company has entered into a contract with the Utah Hotel Company to purchase its isolated steam heating and lighting and power plant. This service will hereafter be furnished from the power company's central system. The contract was negotiated by General Manager C. E. Groesbeck and Division Manager D. C. Green for the power company and the executive committee of the hotel company acting for that institution. Transfer of the property, it is understood, will be made before the first of of the year. The sale price was not made

public but it was stated by a member of the executive committee that the consideration was such as to pay the company for its investment. It is understood that the plant cost in excess of $200,000. The power plant was built by the hotel company at the time the hotel was built in 1911. It supplies light, power and heat to all of the large buildings owned by the Mormon Church in the vicinity of the Temple Square, including the temple tabernacle, assembly hall, Deseret News, Templeton and Vermont buildings, the L. D. S. University, bishop's building, Deseret gymnasium and general church offices, in addition to the Hotel Utah. The company has also done a commercial lighting and power business in the blocks adjoining the plant. By the terms of the contract all of these will be turned over to the power company. The plant has a capacity of 750 kilowatts.

SANTA ANA, CAL.—Sometime during the month of December the citizens of Newport Beach will vote upon a proposition to issue $30,000 in bonds for the construction of a gas distributing system.

PASADENA, CAL.—The city commission has adopted a resolution of intention ordering the installation of posts, conduits, etc., along Colorado street, from the east line of Pasadena avenue to the west line of Los Robles avenue.

CALDWELL, IDAHO.—Plans are under way for the installation of an ornamental street lighting system through the paved district, consisting of four ampere luminous arc lamps mounted on ornamental standard of cast iron.

HELENA, MONT.—Residents of the Broadwater addition have petitioned the city council for the creation of a special improvement district in their section, which will provide for street grading, cement sidewalks, curbing and an ornamental street lighting system.

LOS ANGELES, CAL.—After hearing a petition and protests relating to the establishment of the proposed Lamanda Park Lighting District, the board of supervisors made an order calling an election to be held December 22 for the formation of the district.

## TRANSMISSION.

ABERDEEN, WASH.—Geo. H. Tilden of Seattle has again presented his request for an electric franchise for the streets of Aberdeen for 50 years.

LOS ANGELES, CAL.—The immediate acquisition of the electric distributing systems in all parts of Los Angeles not now served by the Southern California Edison Company, or else the construction of a new municipal system in those districts, has been decided upon by the city council through its approval of the resolution which was adopted by the public service commission. The resolution includes two separate districts, known as the "Eastlake Park, Highland Park and Garvanza District," east of Los Angeles river, and the "Hollywood and East Hollywood Districts." The council resolution sets forth that in provisions for the 1914 power bond issue, amounting to $6,500,000, the sum of $461,351 was set aside for a distributing system on the Eastlake Park, Highland Park and Garvanza District and $408,032 for a system in Hollywood and East Hollywood. It also provides that in case the companies now serving these districts do not offer the lines at a price satisfactory to the city, the municipality shall construct its own lines.

## TELEPHONE AND TELEGRAPH.

NORDHOFF, CAL.—The Pacific Telephone & Telegraph Company proposes extensive improvements in the Ojai telephone lines. Upwards of $3500 is to be expended in betterments immediately.

NORTH BEND, ORE.—H. B. Lincoln, head of the construction department of the Western Union telegraph line, is supervising construction of the line along the Willamette-Pacific right of way to replace the present crude construction.

CLAREMONT, CAL.—Application has been made to the board of trustees for a franchise to construct, and for 38 years to maintain a telephone system in Claremont and sealed bids will be received up to January 3, 1916 for the proposed franchise.

CHEHALIS, WASH.—A franchise was granted Mrs. Mary E. Coffman for the Home Telephone & Telegraph Company at a recent election. This will probably mean immediate completion of rural lines, held up pending settlement of the franchise question.

## TRANSPORTATION.

COEUR d'ALENE, IDAHO.—The matter of an electric railway franchise has been taken up by the council and passed first reading.

LOS ANGELES, CAL.—A year's extension of the franchise held by Henry M. Dennison to build a street car line in Main street, between Slauson and Manchester avenue, has been granted by the city council.

LOS ANGELES, CAL.—The erection of a new railway terminal is under contemplation. According to the present plans the Los Angeles Public Market, Sixth and Alameda streets, will be moved to the present Pacific Electric terminals, while the Pacific Electric terminals will be moved to the present market site.

FRESNO, CAL.—From all indications work will not be resumed on the Fresno Interurban Railway Company's line out of Fresno until after the first of February. Two extensions from this end of the line are being considered. One is to Clovis and the other is into the Centerville country.

SANDPOINT, IDAHO.—At a meeting of the stockholders of the Sandpoint Interurban Railway Company it was decided to issue bonds in the sum of $20,000 to take up notes in the sum of $15,000 and to make further improvement. One of the improvements is to lay a spur track to the Great Northern depot.

## WATERWORKS.

COVINA, CAL.—F. E. Trask, consulting engineer, has been retained by the city of Covina to examine old data and prepare new plans for a domestic water system.

LOS ANGELES, CAL.—The council has instructed the city attorney to prepare an ordinance creating municipal improvement district No. 2 in the San Fernando district, which proposes to vote district bonds for the extension of the city water distributing system.

LOS ANGELES, CAL.—The city council has adopted an ordinance of intention for the creation of Municipal Improvement District No. 1, covering Hollywood, East Hollywood and Colegrove, for voting $1,550,000 worth of water bonds for completing the purchase of the Union Hollywood Water Company's plant and extensions and betterments. The time set for hearing protests is December 8th.

LOS ANGELES, CAL.—The board of public service commissioners has adopted a resolution recommending the purchase of the electrical distributing lines of the Pacific Light & Power Corporation and the Los Angeles Gas & Electric Corporation in the Hollywood and East Highland Park-Garvanza districts, provided the systems can be secured at "a reasonable price." In the event an agreement cannot be reached as to the price, recommendation is made that the city construct a complete electrical distributing system in the districts mentioned. The resolution was submitted as a part of a report of the committee of the whole, embodying several recommendations of Chief Electrical Engineer Scattergood. The districts affected by the resolution are not served in the main lines of the Southern California Edison Company, which the city seeks to acquire through condemnation proceedings.